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COUNTDOWN ACID RAIN

GOVERNMENT SUMMARY AND ANALYSIS

OF THE SIXTH AND FINAL PLANNING PHASE PROGRESS REPORTS

SUBMITTED BY ONTARIO'S THREE MAJOR EMITTERS OF SULPHUR DIOXIDE

IN THE METALLURGICAL SECTOR

June, 1989

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EXECUTIVE SUMMARY

Ontario is both a receptor of acid rain and a source of acid pollutants. The smelting and electric power industries are major sulphur dioxide sources within Ontario, and their pollution is augmented by U.S. acid pollution brought in by prevailing winds. Large areas of the province lie on precambrian granitic rock with little buffering capacity, and acid rain damage is widespread and serious.

Ontario's Countdown Acid Rain regulations came into effect in 1986 and require a specific schedule of emission reductions from each of the four major sources by 1994, and progress reports every six months. A three year research and development phase has culminated in final reports on specific abatement plans, which are the subject of this summary and analysis.

Sulphur Dioxide Emissions*

(thousands of metric tonnes per year)

	1980 base case	1994 limits
Inco nickel/copper smelter, Sudbury	1158	265
Ontario Hydro fossil fuel power plants, province-wide	396	175
Falconbridge nickel/copper smelter, Sudbury	154	100
Algoma iron ore sintering plant, Wawa	285	125

Each of the four major sources has met the emission limits to date, and reports that it will meet the more stringent 1994 limits through the detailed abatement plans shown. The reports of the three metallurgical companies are summarized and analyzed here. Ontario Hydro's abatement plans are examined in a separate document. (Review of Ontario Hydro's January 1989 Acid Gas Plan.)

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* Ontario Hydro also has a limit for the aggregate total of SO_2 plus NO. This total limit drops from 430 kt for 1986 to 280 kt for 1990, and to 215 kt for 1994 and thereafter.

Inco will raise the containment level of sulphur in the ore to 90% by employing new milling technology to reject additional sulphur-bearing pyrrhotite prior to smelting, replacing multi-hearth roasters and reverberatory furnaces with oxygen flash smelting of bulk concentrate and capturing the higher strength gases in a new double-contact acid plant. The total capital cost will be $494 million, of which $69 million has been previously announced for the milling program. A detailed implementation schedule is provided in the Inco report.

Government technical reviewers believe that the above measures will enable Inco to meet the fixed 265 kt limit by 1994, at the full production rate of 240 million pounds of nickel per year. The regulation also requires Inco to examine the economic and technical feasibility of further emission reductions to 175 kt per year or some other quantity reasonably achievable. A preliminary review by government experts indicates that capture of off-gas from the fluid bed roasters may remain a viable method of further SO_2 reduction and recommends that it be explored further.

Falconbridge will achieve the regulated limit of 100 kt at the design production level of 88 million pounds of nickel per year by increased fluid-bed roasting and capture of the resulting SO_2 to produce additional acid in the existing acid plant. The company has also scheduled R&D on increased pyrrhotite rejection to further reduce emissions by about 25% below the 1994 limit. Up to $38 million is allocated to research, development and capital projects.

The government review team believes the above measures will enable Falconbridge to meet the 1994 emission limit, but conclude that the pyrrhotite rejection program should be advanced, if possible, and that further degrees of roast have promise for even greater emission reductions.

Algoma reports that its iron ore sintering plant at Wawa will continue to emit less than the 1994 limit. Production cut-backs are the major reason, combined with the use of lower-sulphur feed.

The government review team was convinced that the company would have no difficulty in meeting the 1994 limit and recommended that a further reduction in the limit be considered.

Ontario Hydro's plans are examined in a separate document. Retrofitting of eight scrubbers is scheduled, together with the increased use of low-sulphur coal. Conservation, demand management and co-generation are also planned. The cost will be $2.46 billion by the year 2000.

COUNTDOWN ACID RAIN

SUMMARY AND ANALYSIS
OF THE SIXTH PROGRESS REPORTS

INTRODUCTION

In Sudbury and Wawa, large amounts of sulphur dioxide (SO_2) are released as a result of processing nickel, copper and iron ores which are bound up with naturally occurring sulphur. Electric power generation is a smaller source of SO_2 in Ontario. Consequently, Ontario differs from most parts of the U.S. where coal-fired power stations are the major source of the SO_2-caused acid rain.

The huge rock formation known as the Precambrian Shield, which provides Ontario's mineral wealth, also underlies thousands of lakes and streams which dot the province. These regions are characterized by thin soil on granitic bedrock which provides little chemical buffering to counteract the incoming acid from the atmosphere. Consequently acid rain damage to the natural environment in Ontario has been severe and wide-spread.

Nature has also provided prevailing storm patterns which move across industrial areas in the United States and cross the southern half of Ontario before heading across Quebec, the Adirondacks and on to the Atlantic regions of the U.S. and Canada. These storms provide half the acidic deposition in Ontario.

Domestic acid rain pollution, thin soil and wind patterns combine to damage Ontario's environment. It shares this unhappy situation with many other jurisdictions in North America and other parts of the world.

During the 1970s governments across North America focussed their concern on local or "ambient" air quality, to ensure clean air for their citizens to breathe.

Any reduction in emissions affects both local air quality and the long-range transport of pollutants. However, rules and regulations designed for the protection of local air quality have been shown to be neither appropriate nor sufficient to deal with pollution on a regional or continental scale. In some cases, for example, taller smoke stacks merely passed the pollution downwind. The acid rain problem stems from the persistent and accumulative long range acid loading on the environment, as many scientific studies have now confirmed beyond doubt.

Limitations on the rate of emissions per unit of heat input or per operating hour or day, while good as a means of improving local air quality, simply do not address the problem of total acid loading. The building of tall stacks to disperse the pollutants made matters worse. Air quality improved near the source, but the total acid loading was merely spread farther afield. Out of sight, out of mind.

Government's needed to devise rules to limit total regional emissions. Canadian and American scientists therefore set to work to determine the level of acid which could be tolerated by surface waters in the natural environment. It was calculated that an annual loading of 20 kilograms of wet sulphate per hectare per year (about 18 lbs. per acre) would protect all but the most sensitive aquatic systems. This "target loading" was accepted as a first step by the Canadian side during U.S.-Canadian acid rain negotiations in the early 1980's, but the U.S. Administration took the position that more research was needed.

Calculating back from the target loading figure, it was estimated that SO_2 emissions in the eastern half of North America should be reduced and capped at about 50% of 1980 levels. This formed the scientific basis for the unilateral program covering the seven provinces which make up the eastern half of Canada.

The Canadian program is founded on the concept of a permanent cap based on annual SO_2 emissions. Reductions are required from sources already in compliance with ambient air quality regulations, which continue as a second layer of legislation.

It was recognized that acceptable levels of acid deposition could not be reached even if all Canadian sources were cut to zero, because of trans-border flows from the U.S. Nevertheless, the program was put in place in the hope that the U.S. would follow with similar action, both out of respect for its international obligations and in order to protect its own environment.

A formal federal-provincial agreement was signed, because the provinces have primary constitutional jurisdiction over stationary sources of air pollution. This is unlike the situation in the United States, where the Federal Environmental Protection Agency can set rules and standards which individual states must follow.

Ontario's Countdown Acid Rain program is the provincial expression of the seven-province agreement of 1985. Ontario went beyond its agreed share of the necessary SO_2 reductions, when its new control regulations, called Countdown Acid Rain, were announced in December 1985. An annual emissions cap of 885,000 tonnes of SO_2 was placed over the province. New sources will have to be fitted within this provincial limitation.

Ontario's Countdown Acid Rain Regulations

Four corporate sources produce about 80% of the SO_2 emissions in Ontario, and a new regulation was passed for each of them, requiring reductions to start in 1986 and be fully implemented by 1994. The required reductions were apportioned among the sources after considering the estimated marginal cost of abatement within the realm of available technology, questions of equity with respect to control measures previously taken, and the economic environment for each of the sources. The new sulphur dioxide limits are shown below in Table 1, in thousands of metric tonnes (kt) per year.

TABLE 1

Source	Sulphur Dioxide Emissions 1980 base case	1994 limits
	(thousands of metric tonnes per year)	
Inco, Sudbury	1158	265
Ontario Hydro, province-wide	396	175
Falconbridge, Sudbury	154	100
Algoma, Wawa	285	125

Ontario Hydro has an additional interim limit of 240 kt of sulphur dioxide, effective in 1990, and a combined limit for total SO_2 and nitric oxide (NO) emissions of 430 kt for 1986-89, 280 kt by 1990 and 215 kt for 1994 and beyond.

In addition to the firm limits shown, Inco was required to examine and report on the feasibility of interim reductions between 1986 and 1994, and the feasibility of a further reduction to 175 kt or some other justifiable number. Falconbridge was required to examine and report on the feasibility of further reductions beyond its 100 kt limit, but no numerical target was specified as in Inco's case.

A useful mechanism in the regulations was the requirement for progress reports every six months during an initial three year research and development phase. This has allowed continuing scrutiny of the developing technical plans, at the same time as allowing each corporation the freedom to arrive at its own solution, as contemplated in the regulations. To date, each of the sources has been within the regulated emission limits. Their reports, which have been open for public examination, show their increasingly detailed plans for emission control. As the corporations now move into the implementation phase, regular reports will continue to be required.

Abatement Plans From the Four Major Sources

The three year R&D phase is now over, and each of the four major sources of SO_2 has submitted its final plans. The corporations have set out in detail their proposed abatement techniques, schedules and expected expenditures for the required emission reductions.

Their plans have been examined by a technical group drawn from the Ministry of the Environment, and by a government review team representing the Ministries of Environment, Northern Development and Mines, Energy, and Treasury and Economics.

In summary, each of the four major SO_2 sources reports that it will meet or surpass the emission reductions required for 1994. The plans of the three metallurgical companies are briefly summarized below, and a more detailed discussion follows. The detailed analysis of Ontario Hydro's report appears as a separate document.

Inco Smelter Complex, Sudbury

Inco Ltd. operates a large nickel/copper smelter with associated milling in the Sudbury area. It has been the largest point source of SO_2 in North America for many years. Inco is required to reduce its annual SO_2 emissions to 265,000 metric tonnes by 1994, and to examine and report on the feasibility of reaching 175,000 tonnes at some future date.

The company will raise the containment level of sulphur arriving in the ore to 90%, with a consequent reduction in SO_2 emissions to the 265 kt level specified by Regulation 660/85. This will be achieved by new milling technology to reject additional amounts of sulphur-bearing pyrrhotite prior to smelting, and by replacing existing multi-hearth roasters and reverberatory furnaces with oxygen flash smelting of bulk nickel-copper concentrate in new flash furnaces. The change in process will produce high-strength SO_2 gas which will be captured and converted to either liquid SO_2 or sulphuric acid. Inco will build a new double-contact acid plant to replace an older, less effective one, and construct new load-out facilities. The total capital cost of all these changes will be $494 million, of which $69 million has been previously announced for the milling program.

The changes are designed to allow Inco to meet the emission requirements while producing at its full capacity of 240 million pounds of nickel per year.

Falconbridge Smelter, Sudbury

Falconbridge Ltd. operates a nickel-copper smelter and ancillary facilities in the Sudbury area and produces sulphuric acid from the SO_2 released during roasting. Extensive modernization took place in the late 1970s, prior to Countdown Acid Rain regulation, and increased SO_2 fixation was achieved at that time. The annual legal emission limit is being further reduced from 154,000 to 100,000 metric tonnes by 1994.

The company will achieve the regulated emission limit at the design production level of 88 million pounds of nickel per year by increased fluid-bed roasting and capture of the resulting SO_2 to produce additional sulphuric acid. Capital costs are estimated at $30 million, and further research and development at $8 million between now and 1994. The company has also scheduled research on methods to reduce SO_2 emission to 75,000 tonnes per year by 1998, which would be a further 25% reduction from the 1994 regulated limit. Reductions beyond the 75 kt level are also being examined.

Algoma Sintering Operation, Wawa

The Algoma Ore Division of Algoma Steel Corp. Ltd. (recently purchased by DOFASCO) operates an iron ore sintering plant at Wawa, which is 270 km north-west of Sault Ste. Marie. Roasting the ore produces a clinker-like material containing about 49% iron, and releases SO_2 from the naturally-occurring sulphur. Algoma's annual SO_2 limit was cut from 285,000 to 180,000 tonnes in 1986, and a limit of 125,000 tonnes was established for 1994.

The Countdown Acid Rain regulation was announced in December 1985. In 1986 sinter production capacity at Wawa was reduced by 55% because continuing economic difficulties in the North American iron and steel industry required a downsizing of operations. The company stated that this change was permanent. As a result, annual SO_2 emissions have been running below the 1994 limit. Technical abatement measures which had previously been examined and found to be expensive have not been pursued, but if economic conditions in the industry improve, the emission limit will not be relaxed.

Government Review of Emission Abatement Plans

The Countdown Acid Rain regulations require reports from the companies in sufficient detail for the Lieutenant Governor in Council (the Ontario Cabinet) to judge the feasibility of the proposed measures.

In addition to the legal requirement, each of the companies received a letter from the Deputy Minister of the Environment in 1986 setting out a list of items to be considered in that company's report at the end of 1988. The companies also received copies of the semi-annual Summary and Analysis reports containing comments by government reviewers.

In the following section, the detailed plan of each of the three metallurgical companies is summarized and the comments of the government review team are shown opposite. The regulations, the Ministry requirements as set out in 1986 and previous government comments have been considered in the analysis.

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INCO'S DECEMBER 1988 PLANNING PHASE FINAL PROGRESS REPORT

Summary	Ontario Government Response
Inco's plans to meet the SO_2 limit of 265 kt in 1994, as required by Reg. 660/85, have not changed significantly from previous progress reports.	Remains satisfactory, except that there is no technical contingency plan. The only possibility appears to be a production cut if the plans fail in part. However, the planned process changes appear feasible.
Studies/research have shown that a suitable technical solution cannot be found in a cost-effective way to lower SO_2 emissions to 175 kt (as contemplated by Section 2(b) and 3(a)(i) of the Regulation).	Emphasis seems to be placed on the economics of the further reduction, as distinct from the technical feasibility. The Regulation also requires consideration of reaching a level of 175 kt/year, and of reaching a level of somewhere between 265 and 175 kt after 1994. Inco's report does not discuss this possibility in detail. The additional reduction would come mostly from the fluid bed roasters, discussed later, and flash converting. The regulation further provides that Inco should indicate the financial assistance that would be required for the company to achieve any of the above emission levels which are technically feasible but judged by the company to be economically not possible. The company has indicated financial assistance will not be required for the reduction to 265 kt/yr.
Inco has responded to the regulatory requirement to examine lowering SO_2 emissions to 525 kt by 1990 and has indicated that due to the retrofitting nature of some parts of the programs to reach the 265 kt level, it would be difficult to meet these two targets concurrently, although interim reductions are possible in 1992.	This argument is convincing, given the nature of the changes being made, and the tight scheduling.

The report states and reiterates in several places that it is important for the Ministry to issue conditional Certificates of Approval so that detailed engineering, equipment procurement and project construction can stay on schedule.

The total estimated capital cost of Inco's SO_2 abatement program is estimated at \$494 million (±10%), and the Board of Directors has approved the necessary funding.

Of this, \$69 million (1988 dollars) will be spent on mill rationalization to improve pyrrhotite (PO) rejection and also achieve productivity gains. This programs shows a discounted cash flow (DCF) return of 22.5% and meets Inco's requirements for capital projects.

The smelter SO_2 abatement program will cost \$425 million (1988), with a DCF return of 5.9%. This rate of return is not generally acceptable to the company and the project would not be undertaken except for the need to lower SO_2 emissions.

Inco will not be requesting assistance from the federal-provincial fund allocated to smelter modernization and SO_2 control.

The SO_2 abatement program consists of:

1. increased PO rejection in the mineral beneficiation circuit, and

2. fixation of strong SO_2 gas streams by smelter process changes.

The Approvals Branch will deal with Certificate of Approval applications expeditiously, and conditional certificates are appropriate in the circumstances. Approvals will be quick provided that the engineering documentation is adequate.

Increased Pyrrhotite Rejection

An overall mill modernization program, known as the Mills Rationalization Program, replaces an earlier proposed technique of SO_2/air PO separation. Technically both methods achieve the same end result, but mill rationalization has greater productivity gains. The program includes increasing throughput of the Clarabelle Mill by 40 kt/day, installing a new 32' semi-autogenous mill, and replacing 24 conventional lines of 100 cu.ft. Denver Cells by 6 lines of 1300 cu.ft. flotation cells. When completed, this system will be able to process about 11 million tonnes of ore annually and will produce about 1.2 million tonnes of 20.6% Cu-Ni bulk concentrate. These changes will reduce SO_2 emissions by about 100 kt by rejecting additional PO. Sulphur rejection of 67% is about the top limit of this operation.

Smelter Process Changes

Smelter process changes consist of sequential building of two new flash furnaces, each with a capacity of 2270 tonnes/day, based on Inco's in-house technology and a month long plant trial in 1987. Engineering design for No. 1 flash furnace has begun and its construction will be completed and process tested before the end of 1991. When both flash furnaces are completed, Inco will be able to produce about 240 million pounds of nickel annually from the new facility. Oxygen injected into the flash smelter will produce 70-80% concentration SO_2 in off-gases which will be fixed in a newly built acid plant. Based on 322 days continuous operation, a total of 430 kilotonnes of SO_2 will be generated from these 2 furnaces.

Changes in smelter process will affect operation of the superstack, which in turn will affect ground level concentrations (GLC) of sulphur dioxide. This issue, which is outside the scope of the Countdown regulation, is recognized in Inco's covering letter to their report. In this context, it is sufficient to note that details of modifications to the stack and anticipated stack parameters will have to be provided by the company to the Ministry, to allow for more in-depth assessment of Inco's possible problems with GLC and the need to meet the relevant ambient air requirements.

Flash furnace matte will be transferred to conventional Pierce-Smith converters to produce bessemer matte. This operation produces variable strength, weak SO_2 gases which wil be cleaned in existing electro-static precipitators (ESP's) to remove particulates and SO_2 bearing gases will be vented through the superstack.

Bessemer matte will be slow cooled, crushed, ground and MK copper sulphide, nickel sulphide, and metallics will be separated by newly developed flotation technology. Extensive changes are already being made to matte processing circuit to increase capacity of various units to handle additional quantities of bessemer matte. No SO_2 emissions will result from the matte separation circuit (although the fluid bed roasters are part of matte processing).

A new MK smelter-converter is being currently developed by Inco to process MK copper concentrate. This is similar to the present copper flash furnace except it will remove more sulphur and produce high grade copper matte and slag (to be discarded). This MK converter matte will need very little further sulphur removal in copper finishing converters. The new process will produce 65 kilotonnes of strong SO_2 gas (70-80% strength) annually which will also be fixed in the new acid plant. SO_2 emissions from the copper converters will be relatively small and the process generates weak SO_2 off gases. These gases will be cleaned in the ESP for particulate removal and vented through the superstack.

Previous progress reports made mention of N_2 injection during MK matte converting (semi-blister copper) as a way of reducing build-up of Nickel-Oxide mush. Details about NO_x emissions from this process are needed.

These changes in the copper circuit will reduce fugitive emissions. The reviewers were pleased with this development. More details on the extent of the improvement in fugitive emissions should be provided by the company.

The nickel sulphide component of the matte will be treated in the fluid bed roasters to produce nickel oxide product and SO_2 bearing off-gases will be vented through the superstack after cleaning for particulates. At present, Inco has no definite plans to fix the 75 kilotonnes of SO_2 emissions per year from this operation, due to claimed technical difficulties and poor economics.

Inco should provide justification for this position, as detailed later.

Blister copper from the finishing converters will be transferred to anode furnace in the copper refinery.

Oxygen Plant

A new oxygen plant will be built to meet additional O_2 requirements of the new flash furnaces. Other utilities will be upgraded as required to meet the needs of the new smelting processes.

SO_2 Fixation

Strong SO_2 off-gases generated in bulk concentrate smelting and MK flash converting will be treated in a newly built 2900 tpd double contact process acid plant to produce sulphuric acid product for sale. Inco also plans to build new acid loading facilities. The acid plant will be ready in the latter part of 1991 to handle strong SO_2 gases from the bulk concentrate flash smelting. The acid plant is designed to handle additional SO_2 bearing gases to further reduce SO_2 emissions to 175 kilotonnes in the future. SO_2 fixation systems will produce 580 kt of acid and 80 kt of liquid SO_2.

The government reviewers noted that the location of the new acid plant, and the new load-out facilities would eliminate the need for a long sulphuric acid pipeline.

The acid plant must be able to handle not only new and future sources of SO_2, but also the peak daily volumes under conditions in which all possible gas capture systems are operating. Sufficient detail to demonstrate this should be provided by Inco under the final Certificate of Approval process.

Overall when the entire program changes have been completed, Inco plans to shut down the IORP acid plant and total SO_2 emissions from the remaining facilities will not exceed 265 kilotonnes per year.	
Future SO_2 fixation would likely come from flash converting of bulk concentrate matte which Inco is investigating. Research and pilot testing studies in this area are planned for the next 3 years and the company has approached the Federal Department for partial funding of the $11 million research program under regular assistance schemes.	This is a promising area for SO_2 reductions, relatively independent from the other parts of the abatement program. It appears to be a necessary component in reaching the 175 kt level and beyond. Inco should provide a schedule for this research program. Contamination off-gases by H_2S from the flash furnaces was previously identified as a concern. It is not mentioned in the company's final report. If not resolved, an H_2S problem could adversely affect down-stream SO_2 fixation. Information on this point will be required for the Certificate of Approval process.
The report also indicates that other processes, e.g. fixing SO_2 from matte processing fluid bed roasters (FBR) and bessemer matte converters have been found economically unattractive and also yield partial SO_2 fixation and/or inferior product acid.	Inco previously indicated that fluid bed roaster gases could be captured to help reduce total SO_2 emissions as per the Acres, Davey, McKee report. The unattractive economics should be detailed as well as any technical difficulties, as required by the Regulation. A preliminary review of company documents indicates that capturing FBR gases remains technically feasible, and the reviewers believe Inco should provide more information and discuss it with the Ministry.
Financial data and a report on the socio-economic impact on the Sudbury Region of Inco's emissions abatement program (prepared by Laurentian University) were submitted with the final report.	

The socio-economic study concluded that direct construction employment and indirect employment that is the result of the purchases of construction materials will increase from close to zero in 1988 to approximately 582 full-year jobs in 1990. Direct construction employment and related indirect employment will fall back to zero in 1994 when the construction phase of the project is completed.

The abatement project will eventually lead to a decline in employment because the operation of the mill, smelter and new acid plant will require fewer workhours per unit of output. However, during the construction period there will be a temporary increase in the number of required operators. From 1988 through 1990 direct employment in the operation of the mill, smelter and acid plant will increase by some 60 full-year jobs. After 1990 labour requirements will decline and by 1994 employment at the mill, smelter and acid plan will be some 400 full-year jobs below the 1988 level.

The report indicates that the abatement program will cause a 1,978,000 workhour increase in total regional employment and a $44,478,000 increase in total regional income in 1990. However, once construction is completed and employment at the mill, smelter and acid plant is adjusted to the lower requirements in 1994, total regional employment and income will decline by 1,122,000 workhours and $16,980,000. The authors of the socio-economic report do not consider these changes to be significant in the context of the total local economy.

The socio-economic study, done for Inco by Laurentian University, was a good addition to the main report, and dealt well with the requirements of the Regulation, the Deputy Minister's letter of June 5, 1986 and previous comments by government reviewers.

The eventual reduction in employment will take place through normal attrition and therefore no layoffs are anticipated.

The socio-economic report also recognized the improved work environment for the remaining workers.

Ministry Requirements as Set Out in June, 1986

Inco's report responds to most of the items in the letter of June 5, 1986 from the Ministry. The letter notes that this information would be "essential should government funding be sought." It is recognized that Inco has indicated that it is not seeking any direct subsidy from the funds which were set up as part of the federal- provincial acid rain abatement agreement, but is seeking tax assistance from the federal government for research and development costs. Accelerated capital cost allowance may be available for approved pollution control equipment.

The Ministry requirements were broken into a number of headings, which are followed below. Issues covered or not covered in Inco's report have been placed under the appropriate heading. The government comments are in the right-hand column.

Research and Development Required to Comply with Regulation

Inco's report indicates that research in progress on MK copper converting should not delay implementation of the SO_2 abatement program planned for 1989-1994. Further research studies planned for bulk concentrate matte flash converting in the next few years, if successful, have a potential to reduce SO_2 emissions below 265 kilotonnes after 1994 by additional fixation of SO_2 in strong gas streams.

Anticipated Financing Requirements and Timetable

The company has indicated that these new flash converting studies will cost $11 million and application has been made to the Federal Government for financial assistance.

No further breakdown of research budget and schedule is provided. The provincial burden is not identified.

Annual SO_2 Emissions and Production Levels

SO_2 emissions for 1988 are estimated to be 650 kilotonnes. Production of nickel is rated at 240 million pounds.

No data on copper, cobalt and other trace precious metals are provided. No SO_2 emission and metal production projections for 1989 to 1993 are given.

Processes Selected to Achieve Regulated Emission Levels

The company has clearly identified the selected processes and their SO_2 emissions in this report and also indicated that the new acid plant will be used to fix 495 kilotonnes of SO_2 annually at 90% efficiency.

Anticipated Implementation Dates

Dates and related costs to be incurred yearly between 1988-1993 have been given.

Production Levels and Effects on Local and Workplace Environment

Production of 240 million pounds of nickel has been indicated. Due to process changes fugitive SO_2 emissions will be reduced which will improve the work place environment.

This is a positive change, but confirmation and details should be provided by the company.

It is noted that Inco has stated that it may continue to have ambient air quality problems in the region of the smelter complex. Nevertheless, Inco will have to continue to meet the applicable standards.

Processes Considered But Not Selected

Some reasons are provided for not selecting other processes to meet current SO_2 emission requirements or to further reduce SO_2 emissions below 265 kilotonnes.

As previously noted, the potential to use some technically feasible methods has been undermined by reliance on economic tests.

Capital and Operating Costs for Selected Elements

A capital cost estimate of $494 MM (±10%) is provided.

Estimated Savings

Estimated savings of $64 million resulting from process changes have been outlined. Mill rationalization is noted to have a positive return of 22%, and smelter changes produce a positive return, although not at opportunity cost.

Some of the $150 million already spent to research the needed technology may be recovered by sale of the technology.

Proposed Method of Financing and Timetable

A proposed schedule for capital expenditure is given.

It seems that the company is budgeting for these changes.

Financial Statements for Specific Plant and Consolidated Company

Consolidated statements are provided in a separate report.

It is recognized that the detail requested assumed that Inco would be requesting financing from the special federal-provincial fund, but that this is not the case.

Socio-Economic Considerations

These are well considered in the companion report.

General Comments by Government Review Team

In general, Inco's final report on the planning phase of the Countdown Acid Rain regulation was satisfactory. The major outstanding issue is the extent to which Inco can reach an SO_2 emission level below 265 kt per year. The relevant provisions of the regulation have been addressed, but not to the satisfaction of the technical review group, as noted previously. The review team believes that Inco should provide additional information with respect to fixing the fluid bed roaster (FBR) off-gases, since this appears to be technically feasible. If the research and development work is favourable, then the Ministry would expect the technology to be implemented on a defined schedule.

As noted, the only real contingency plan appears to be a cut in production if parts of the proposed technology fail to work to expectations.

As noted in the Summary and Analysis of the Fifth Progress Report, technical problems due to the formation of high melting point oxidic mush, proper converter heat balance and use of reducing agents/fuels must be resolved. If not solved it could mean limited use of scrap in converting and could affect the nickel scrap recycle market. More details are needed on the use of N_2/air mixtures in tuyers to reduce NiO mush to ensure no increase of NO_x emissions from this source.

The Ministry of the Environment will continue to concern itself with GLC limits, as the abatement program moves forward. The test of due diligence will continue to apply.

FALCONBRIDGE'S DECEMBER 1988 PLANNING PHASE FINAL PROGRESS REPORT

Summary	Ontario Government Response
The company's approach is the same as stated in detail in the 5th Progress Report which includes: - removal of 65% of the sulphur present in the concentrate in the roasters and fixation of the SO_2 in the roaster off-gases in a single contact acid plant.	The company's final planning phase progress report indicates that research performed in the past several years is well on the way to meet the Ontario Reg. 661/85 limit of 100 kilotonnes of annual SO_2 emissions. A combination of process changes and additional SO_2 fixation in acid plant will be used.
- smelting of calcine with a reducing agent (coke) in an electric furnace. - better process control of nickel converters with computers - separate converter slag cleaning for increased metal recoveries before recycling the slag back to electrical furnace.	The reviewers noted that the company will be using a single contact acid plant process. A double contact process would increase the fixation of SO_2 to sulphuric acid. No economic or technical justification was given for the company's choice and it should be provided.
- improvements to the Strathcona Mill to yield higher nickel recoveries and pyrrhotite (PO) rejection.	As noted subsequently, it now appears that PO rejection beyond current levels may not be needed to reach the 100 kt SO_2 emission limit, but will enable the company to make further reductions.
A number of technologies were developed by the company in-house and some of the operations/processes have already been retrofitted. Plans for the remaining work have been outlined. In addition to a substantial R&D expenditure in the past, the company now plans to spend about $8 million for further research and $30 million for process changes needed at the Strathcona Mill (modernization program) and the smelter.	The implementation process changes seem to be in order and logical. Because of retrofitting equipment during plant shutdown a very limited time is allowed for commissioning. This needs to be monitored closely and should be mentioned in future implementation phase progress reports.

The company plans to spend up to $38 million on research, development and capital projects. Nine million is expected to be spent in 1989. The 1989-1993 expenditures are:

Strathcona Mill Modernization	$12 million
Smelter and Acid Plant Increased Roast	18
Research	8
	$38 million

The capital cost estimate includes a 25% contingency. The capital cost components include mechanical equipment, materials, installation labour, engineering costs and indirect costs.

The company is not seeking funding assistance for the capital expenditures from the special federal-provincial acid rain fund. However, a request may be made for funding for research and development. The company wants assistance for a portion of the $8 million.

The design production capacity of the smelter is rated at 88 million pounds of nickel and even with changes currently in place SO_2 emissions at the design level would have been 105 kilotonnes. 1988 SO_2 emissions from this plant are estimated to be 62 kilotonnes at a nickel production of 60 million pounds. Sulphur removal of 63% has been successfully achieved in the roasters.

These cost estimates from the company's report are difficult to cross-reference to the other tables involving costs. It is also not clear whether some operating costs such as repair and maintenance have been included in the capital cost estimates.

The government's overall economic evaluation should recognize both the positive and negative effects on cash flows attributable to capital expenditures, operating cost changes, metal recoveries, and income and mining taxes associated with the overall project.

If such a request is made then additional details on the $8 million will be required.

This is well below the Ministry's present regulated limit and SO_2 emissions are estimated to be only 5% above the 1994 requirements at design production.

Electric furnace operating problems have been further resolved by separating copper concentrate from the feed. This has enabled the company to smelt deeply roasted calcine with additional reductant (coke) without metal build-up on the hearth and superheated slag. It appears that the presence of copper (in oxide form) increases the matte forming temperature. This also enables the company to use rich metal scrap in smelting, thus further tying up additional sulphur.

Pierce Smith converters used for treating electric furnace matte have been equipped with better controls to handle high grade matte as a result of deeply roasted concentrate.

The converter slag cleaning process developed by the company is working well and has reduced the recycle slag load on the electric furnaces by 20%.

Changes implemented at the Strathcona Mill in mineral processing areas have reduced the PO content of the concentrate by improving the magnetic separation circuit, separate treatment of low PO - high metal content ore, and removal of copper concentrate from ore by chemical agents and column flotation techniques.

Since commissioning the new smelter in 1978 further process changes implemented by the company have resulted in reducing SO_2 emissions from 2 to 1 pound per pound of nickel production or 50%. The report also indicates that Falconbridge plans to continue further research and other studies to reduce SO_2 emissions to 75 kilotonnes at

As the report notes, Falconbridge will not depend on further PO reduction in the concentrate to reach the regulated limit of 100 kt/yr. But the planned research program on PO rejection over the next four years will aid in reductions below the 100 kt level.

design nickel production of 88 million pounds from this facility. Two areas identified in this report include:

(a) increasing sulphur removal in roasting operation from 63 to 80% without sulphation, and

(b) a combination of further changes at Strathcona Mill in mineral classification equipment, flotation and process control areas followed by research to further reduce the PO content of the concentrate below 53%.

Success will depend on obtaining a high grade concentrate with low metal losses in PO reject material. Nickel loss must be kept below 1.5% to be acceptable to the company. It is estimated that this will result in additional SO_2 emissions reduction of 24 kilotonnes/yr without economic penalty and sustained development of company's mineral resources at design nickel production.

The time frame indicated by the company to implement this objective, if successful, is from 1994 to the year 2000. Money to continue some parts of this work is not included in the current budget of $38 million.

The company has outlined the monies spent in SO_2 emissions-related programs in the past and indicated that they were unable to allocate proper resources to mineral body development program. No formal request for financial assistance has been indicated in this report.

The reviewers were encouraged by the section of the report dealing with SO_2 reductions beyond the 75 kt level by means of increased roast. Rough estimates indicate successful implementation of 80% roast could further reduce emissions to half the 75 kt level. The Ministry should be apprised of the anticipated schedule for implementation of these advances.

Previously, the company had indicated that increased PO rejection would help them reach the regulated limit. Now they indicate that the PO rejection program will be implemented between 1994 and 2000, while the 100 kt limit will be met by other measures. The review team was concerned about this stretched-out time frame. Regulation 661/85 requires consideration of ways to reach levels below the 100 kt limit. The Ministry should be apprised of the technical and/or economic reasons for postponing the implementation of the PO rejection technology, with a more detailed rationale for the time-table and costs, since it is not clear to what extent the difficulties in reaching the 75 kt level are economic, as opposed to technical.

Ministry Requirements as Set Out in June, 1986

This final planning phase progress report of Falconbridge responds to most of the items listed in the letter of June 5, 1986 from the Ministry.

Research and Development Required to Meet Regulated Limit

Additional research studies planned will likely take the company beyond the requirements of Reg. 661/85.	Research and development outlined in the 5th Progress Report and work plan has not changed significantly.

Anticipated Financing Requirements and Time-table

The company has indicated that about $8 million will be spent in research activities between 1989 and 1993.	No changes are reported in the earlier work program/time-table. Only cursory indication is given for work planned beyond 1993. Also no details on research budget are provided.

Annual SO_2 Emissions and Production Levels and Projections

SO_2 emissions information provided for 1988 indicates that the company estimates are 62 kilotonnes SO_2 at 69 million pounds of nickel production.	No projections are given for 1989 to 1993 but the report indicates that even at design nickel production SO_2 emissions would not increase over 100 kilotonnes/yr.

Processes Selected to Achieve Regulated Emission Limited

The company has clearly identified the selected processes in this report and referred to detailed descriptions in earlier reports.

Anticipated implementation dates and related costs to be incurred yearly between 1989 and 1993 have been provided (Table 4.2 of the company report).

The report has provided reasons why historical and current processes were not selected or pursued further due to marginal economics and resource conservation considerations.	Information on projected production levels is not given and local/work place environment is not assessed.

Detailed Capital and Operating Costs Required to Meet the Regulated Limits

Capital cost estimates of \$18.4 million are provided for all process elements listed in 2(a) of the Deputy's letter.	No details are provided on O/M costs but these are not expected to change significantly from the current levels. Additional O/M cost may be incurred due to increased use of coke in smelting and catalyst in the acid plant. Acid plant waste treatment costs could rise.

Detailed Financial Information and Time-table

A proposed schedule for capital expenditures is provided.	The method is not outlined. It appears that the company is budgeting for these changes. Company's financial statements (annual reports) for current and previous 4 years have not been provided. Company's financial plans for next 5 years are not given at present. The reviewers recognize that much of the detailed information requested in the letter of June 6, 1986 was based on the assumption that Falconbridge would be requesting money from the special federal-provincial acid rain fund. No formal request has been received, at the provincial level, although it is not clear how much funding assistance is being requested, from whom, or in the form of tax relief, grants or

loans. It should be noted that the federal-provincial fund for smelter modernization and SO_2 control does not cover research and development. The company will have to provide a breakdown of the planned $8 million expenditure and provide more detail if money is being requested from Ontario.

Socio-Economic Considerations

In general, the reviewers found that the report did not deal with socio-economic issues.

An employment schedule is not provided but it is estimated that based on planned process changes the short term impact on Sudbury area labour force should be favourable.

The company has not outlined any plans to alter the work force from the current level with any consequent community/regional effects.

General Comments on Falconbridge's Planning Phase Progress Report

As noted, the company appears to be moving towards the necessary emission controls in an adequate fashion, and the review team was pleased to note the planned schedule of work on PO rejection aimed at an SO_2 emission rate of 75 kt per year at the design production rate of 88 million pounds of nickel, and the possibility of substantial reductions beyond that if increased roast research and development is successful.

The report has not provided enough detail to enable a judgment to be made on the technical and economic feasibility of the proposed projects, and as noted, more information should be provided. If the research results are favourable, the Ministry would expect the proposals to be implemented on a defined schedule.

While the company's plans appear feasible, the reviewers noted that the only apparent contingency plan is to produce below design capacity.

The company has expressed concern over the need to receive Certificates of Approval in a timely fashion. This should not pose a problem provided adequate detail is in the applications.

The review team noted that Section 3 of Regulation 661/85 required Falconbridge to examine and report on the feasibility of reaching an emission level below the fixed 100 kt limit for 1994, and noted that the report has done so, although in a general manner. It would appear that financial constraints related to the development of technology are limiting factors. The reviewers recommend that consideration be given to lowering the SO_2 fixed emission limit further in the next phase.

ALGOMA'S DECEMBER 1988 PLANNING PHASE FINAL PROGRESS REPORT

Summary	Ontario Government Response
The final planning progress report concerning the Algoma Ore Division sintering plant in Wawa indicates that the company's strategy has not changed. Emissions have been cut to levels below the 1994 requirement by a major cutback in sinter production, together with the use of purchased low-sulphur iron oxides, which are the waste products from other producers, and greater reliance on lower-sulphur ore.	The Ministry has contacted the new owner, Dofasco, to remind the company of the requirements of Regulation 663/85. As previous comments have indicated, if economic conditions improve and the company wishes to increase production again, appropriate steps would have to be taken to ensure that emissions stay below the regulated limit of 125 kt per year by 1994. The company acknowledged this point in its report.
In 1988 sinter production increased slightly to 1,085,000 G.T. and SO_2 emissions were reduced slightly to 80,000 metric tonnes, due mainly to the use of low sulphur oxides in the mix.	Increased use of low-sulphur feed was noted as a means of reducing SO_2 emissions. The Ministry would like details on how much low-sulphur feed is purchased and used and its actual and potential function in reducing emissions.
	Metric measures should be used throughout in future reports. The 1988 reported sinter production of 1,085,000 G.T. is equal to about 1,086,000 metric tonnes.
The report contains an overview of the company's and Ministry's SO_2 abatement activities since 1961. These actions include production cutbacks and a number of control orders limiting SO_2 emissions.	
In 1978 the Ministry approved a method to adjust the production rate to reduce adverse SO_2 impact on local air quality based on weather forecasting. Algoma installed the necessary ambient air SO_2 monitors and this system is still in use. The company also hired Thyssen Engineering to study the applicability of wet limestone scrubbing technology to reduce SO_2 levels in sinter plant flue gases. This study concluded that SO_2 abatement would increase the cost of sinter production by	The 1982 Thyssen study indicated that SO_2 control would result in a capital cost of \$99.4 million with an annual operating cost of \$18.5 million.

48% and make Wawa plant less competitive with other iron ore processing operations. Later pilot studies to separate pyrite (FeS) from siderite ore in 1984-85 indicated that SO_2 emissions could be reduced by 30% if the overall recovery is 69%. However, silica removal in this process was poor and the overall recovery did not reach the expected levels.

A social impact study by Canada Consultant showed that Algoma Wawa's plant closure would result in loss of about 1,200 jobs.

In view of the overall impact from SO_2 emissions and plant closure, the company started cutting back sinter production to meet softer steel markets in 1986, and at the same time, to meet the SO_2 emission limit set for 1994 and thus reduce the social impact on the township of Wawa.

Ministry Requirements as Set Out in Letter of June 5, 1986

Annual Emission and Production Levels

Data on 1988 SO_2 emission (80 kilotonnes) at 1.1 million tonnes of sinter production are provided. Emissions per tonne of sinter are expected to vary from year to year, depending on the availability of low sulphur oxides and siderite ore grade.

Annual SO_2 emissions and sinter production projections until 1994 are not given, but the company has stated that the sinter production downsizing will make it possible to meet the 1994 limit on an annual basis.

Process Selected to Achieve Emission Levels Required by the Regulation

SO_2 abatement methods are not applicable due to poor cost-effectiveness of currently available SO_2 abatement technologies. Sinter production has been adjusted to meet the SO_2 emissions limit set by Regulation 663/85 and the control order requirements.

Capital and Operating Costs Required to Meet Reduce SO_2 Emission Levels

No additional changes are needed to the present operation.

Financial Details

Not applicable.

Socio-Economic Considerations

Reducing sinter production from 2 million to 0.9 million G.T. reduced the work force and reportedly lowered morale in 1986. However, the town and surrounding communities did escape the severe impact which could have resulted from total closure of this operation.

Social impact details are not quantified. Any future changes should include a socio-economic analysis.

General Comments By Government Review Team

There appears to be no problem with the company meeting the 1994 SO_2 emission limit. In fact, based on the information supplied, production modifications at the plant and changes in feed have been made which effectively limit SO_2 emissions to about 80 kilotonnes per year. Consequently consideration should be given to revising Regulation 663/85 to further lower the emission limit.

It should be confirmed that the plant's rated capacity has been permanently down-sized, and the exact capacity determined. The company should be advised that any process changes or changes of annual sinter production warrant an application for a Certificate of Approval from the Ministry of the Environment. In any event continuing semi-annual reports will be required as per the Regulation, even to confirm that no changes are contemplated.

The reviewers noted the findings of Dr. Weisman's 1980 study that Algoma's contribution to sulphate and acidic loading is "negligible" for ecologically sensitive areas in Central Ontario, and that "area lakes are sufficiently buffered not to be threatened by acid component input at currently observed total input levels". In response, the reviewers note several local damage to forested areas and that the many small percentage contributions add up to the huge problem of acid rain in eastern North America, and that in fact one sensitive lake in adjacent Pukaskwa Park has been observed to become acidified.

APPENDIX I

COUNTDOWN ACID RAIN

ONTARIO'S ACID GAS CONTROL PROGRAM FOR 1986 - 1994

TEXT OF REGULATIONS

ONTARIO REGULATION 660/85

REGULATION MADE UNDER THE ENVIRONMENTAL PROTECTION ACT

INCO SUDBURY SMELTER COMPLEX - 1994

1. (1) Inco Limited shall not emit sulphur dioxide from its Sudbury Smelter Complex in the Regional Municipality of Sudbury on any day in any year after its emissions of sulphur dioxide in that calendar year exceed 685 kilotonnes.

(2) Inco Limited shall not emit sulphur dioxide from its Sudbury Smelter Complex in the Regional Municipality of Sudbury on any day in any year after its emissions of sulphur dioxide in that calendar year exceed 265 kilotonnes.

(3) Subsection (2) comes into force on the 1st day of January, 1994.

2. Inco Limited shall,

(a) perform such studies and research as are necessary to establish the best available technology and design, and the costs thereof, to assure that the emission limit referred to in subsection 1(2) is not exceeded;

(b) perform such studies and research as are necessary to establish the best available technology and design, and the costs thereof, to limit emission levels of sulphur dioxide to less than 175 kilotonnes a year;

(c) perform such studies and research as are necessary to establish the best available technology and design, and the costs thereof, to limit emission levels of sulphur dioxide to 525 kilotonnes a year by 1990 and further reductions before 1994; and

(d) submit written reports to the Minister by the 31st days of January and July in each year starting with the 31st day of July, 1986 to and including the 31st day of July, 1988 on the progress being made on the matters referred to in clauses (a), (b) and (c).

3. Inco Limited shall, by the 31st day of December, 1988, submit to the Minister a final written report of the studies and research referred to in section 2 in sufficient detail to enable the Lieutenant Governor in Council to assess,

(a) Inco Limited's corporate decisions on the economic and technical feasibility of:

  (i) achieving emission levels of sulphur dioxide of 175 kilotonnes a year,

  (ii) achieving some other specified level of emissions lower than the limit prescribed in subsection 1(2), and

  (iii) meeting the limit of 265 kilotonnes prescribed by subsection 1(2);

(b) in the event that a limit or other level referred to in clause (a) is technically achievable but it is Inco Limited's corporate decision that it is not economically possible to achieve or meet that level, the financial assistance that Inco Limited would require to achieve that level; and

(c) the methods or plans proposed by Inco Limited to meet the emission levels referred to in clause 2(c) and in clause (a).

4. After the 31st day of December, 1988, Inco Limited shall submit semi-annual written reports to the Minister on the progress being made in implementing the methods or plans developed for purposes of this Regulation.

5. Regulation 301 of the Revised Regulations of Ontario, 1980 is revoked.

Filed with Registrar
of Regulations: December 17, 1985

Published in
Ontario Gazette: January 4, 1986

ONTARIO REGULATION 661/85

REGULATION MADE UNDER THE ENVIRONMENTAL PROTECTION ACT

FALCONBRIDGE SMELTER COMPLEX - 1994

1. (1) Falconbridge Limited shall not emit sulphur dioxide from its Smelter Complex in the Town of Nickel Centre in the Regional Municipality of Sudbury on any day in any year after its emissions of sulphur dioxide in that calendar year exceed 100 kilotonnes.

   (2) This section comes into force on the 1st day of January, 1994.

2. Falconbridge Limited shall,

   (a) perform such studies and research as are necessary to establish the best available technology and design, and the costs thereof, to assure that the emission limit referred to in section 1 is not exceeded;

   (b) perform such studies and research as are necessary to establish the best available technology and design, and the costs thereof, to achieve such other lower sulphur dioxide emission levels as are economically and technically feasible; and

   (c) submit written reports to the Minister by the 31st days of January and July in each year starting with the 31st day of July, 1986 to and including the 31st day of July, 1988 on the progress being made on the matters referred to in clauses (a)and (b).

3. Falconbridge Limited shall, by the 31st day of December, 1988, submit to the Minister a final written report of the studies and research referred to in section 2 in sufficient detail to enable the Lieutenant Governor in Council to assess,

   (a) Falconbridge Limited's corporate decisions on the economic and technical feasibility of:

      (i) achieving some specified level of emissions lower than the limit prescribed in section 1; and

      (ii) meeting the limit of 100 kilotonnes prescribed by section 1;

(b) in the event that the limit or other level referred to in clause (a) is technically achievable but it is Falconbridge Limited's corporate decision that it is not economically possible to achieve or meet that level, the financial assistance that Falconbridge Limited would require to achieve that level; and

(c) the methods or plans proposed by Falconbridge Limited to meet the emission levels referred to in clause (a).

4. After the 31st day of December, 1988, Falconbridge Limited shall submit semi-annual written reports to the Minister on the progress being made in implementing the methods or plans developed for purposes of this Regulation.

Filed with Registrar
of Regulations: December 17, 1985

Published in
Ontario Gazette: January 4, 1986

ONTARIO REGULATION 663/85

REGULATION MADE UNDER THE ENVIRONMENTAL PROTECTION ACT

ALGOMA SINTER OPERATION - 1986/94

1. Algoma Steel Corporation Limited shall not emit sulphur dioxide from its Sinter Operation at Wawa on any day after its emissions of sulphur dioxide in that calendar year exceed 180 kilotonnes.

2. (1) Algoma Steel Corporation Limited shall not emit sulphur dioxide from its Sinter Operation at Wawa on any day after its emission of sulphur dioxide in any calendar year exceed 125 kilotonnes.

   (2) This section comes into force on the 1st day of January, 1994.

3. Algoma Steel Corporation Limited shall,

   (a) perform such studies and research as are necessary to establish the best available technology and design, and the costs thereof, to assure that the emission limit referred to in section 2 is not exceeded; and

   (b) submit written reports to the Minister by the 31st days of January and July in each year starting with the 31st day of July, 1986 to and including the 31st day of July, 1988 on the progress being made on the matters referred to in clause (a).

4. Algoma Steel Corporation Limited shall, by the 31st day of December, 1988, submit to the Minister a final written report of the studies and research referred to in sections 3 in sufficient detail to enable the Lieutenant Governor in Council to assess the methods or plans proposed by Algoma Steel Corporation Limited to meet the limit prescribed by section 2 and the financial assistance, if any, that Algoma Steel Corporation Limited would require to meet that limit.

5. After the 31st day of December, 1988, Algoma Steel Corporation Limited shall submit semi-annual written reports to the Minister on the progress being made in implementing the methods or plans developed for purposes of this Regulation.

Filed with Registrar
of Regulations: December 17, 1985

Published in
Ontario Gazette: January 4, 1986

APPENDIX II

Ministry of Environment Requirements As Set Out in Identical Letters to Inco Ltd., Falconbridge Ltd. and Algoma Steel Corporation Ltd.

June 5, 1986

Dear ——:

As you are aware, the regulation enacted at the end of 1985 affecting sulphur dioxide emission reductions by your company requires interim progress reports. The first report in this series is due July 31, 1986.

In order to ensure that the information you are planning to submit will meet the requirements of the Ministry and will be provided in a similar format across the four industries involved, we request the following information.

A. Research and development required.

   a) Current status of research and development aimed at SO_2 emission reductions.
   b) Anticipated areas of research, description of specific projects and purpose of project to the overall reduction scheme.
   c) Workplan and anticipated timing.
   d) Identification of preferred process route(s) and gross estimate of capital costs.

B. Financial.

   a) Anticipated financing requirements.
   b) Timetable.

While the foregoing information is deemed to be sufficient for the first report, it would seem prudent at this time to advise you of what we initially consider as minimum requirements for the final report contents. This information will be essential should government funding be sought. With this in mind, the final report should address at least the following.

1. Annual emissions (SO_2) and production levels.

   a) 1988 annual levels and sources.
   b) Annual projected levels through to 1994. (note: production figures in the mining sector should include nickel, copper, other metals and acid).

2. Selected process to achieve emission levels set out in the Regulation.

    a) Identification of selected process elements and description of each.
    b) Anticipated implementation dates for each element.
    c) Projected production levels and effects upon the local and workplace environment.
    d) Identification of processes considered but not selected and the rationale for not selecting them.

3. Capital and operating costs required to meet reduced emission levels.

    a) Estimated capital and operating costs for each process element identified in 2 a).
    b) Estimated savings (i) from reduced operating costs, (ii) from increased recovery of metals and sale of byproducts.

4. Financial.

    a) Proposed method of financing and timetable (prepare several scenarios based on different metal and acid prices).
    b) Latest and previous four year-end financial statements for specific plant and consolidated company.
    c) Project financial statements for the next five years (including assumptions).

5. Socio-economic considerations.

    a) Employer (manpower plan).
    b) Community/regional economic implications.
    c) Spinoff benefits.

With the exception of the requirements of the initial report, the items requested are a proposal at this stage and we would certainly welcome any suggestions you may wish to make.

I should also add that the main body of the report will be considered a public document therefore it is suggested that any information of a proprietary nature be placed in a separate document. Your rationale for the need for confidentiality should be set out in the main body of the report.

I look forward to the first of the series of these reports on July 31, 1986.

Yours sincerely,

R.M. McLeod, Q.C.
Deputy Minister